

## CLAIMS

We Claim:

1. A bobbin assembly for use in an electrical machine, the bobbin comprising:
  - an annular rigid sleeve defining an outside diameter;
  - a first end cap formed of thin sheet material having inner flaps, outer flaps, and a side wall positioned between the inner flaps and outer flaps, the inner flaps being formed inward to fit over the outside diameter of the rigid sleeve;
  - a second end cap formed of thin sheet material having inner flaps, outer flaps, and a side wall positioned between the inner flaps and outer flaps, the inner flaps being formed inward to fit over the outside diameter of the rigid sleeve;
  - an annular excitation winding having an inside and an outside diameter and opposing sides surfaces; and
  - wherein the inner flaps of the first and second end caps are positioned between the outside diameter of the rigid sleeve and the inside diameter of the annular excitation winding, the outer flaps of the first and second end caps extend over the outside diameter of the annular excitation winding, and the side walls of the first and second end caps extend over the opposing side surfaces of the excitation winding.
2. The bobbin assembly of claim 1 further comprising a ring of inner tape adhering the first end cap inner flaps and second end cap inner flaps to the rigid sleeve.

3. The bobbin assembly of claim 1 further comprising a ring of outer tape wrapped around the folded outer flaps of the first and second end caps and the excitation winding.

4. The bobbin assembly of claim 1 wherein the first end cap is generally star shaped having a centered generally circular aperture, the first end cap having an outer periphery and an inner periphery wherein the outer flaps are positioned around the outer periphery and the inner flaps are positioned around the inner periphery; and wherein the second end cap is generally star shaped having a centered generally circular aperture, the second end cap having an outer periphery and an inner periphery wherein the outer flaps are positioned around the outer periphery and the inner flaps are positioned around the inner periphery.

5. The bobbin assembly of claim 4 wherein the first end cap has an outward facing side and an inward facing side, wherein the inner flaps are folded generally 90° from the inward facing side; and wherein the second end cap has an outward facing side and an inward facing side, wherein the inner flaps are folded generally 90° from the inward facing side.

6. The bobbin assembly of claim 1 wherein the bobbin is used in a rotor assembly for an electrical machine, the rotor assembly further comprising a front claw pole section and a rear claw pole section that combine to form a claw pole assembly, wherein a hub is integrated into the claw pole assembly.

7. The rotor assembly of claim 6 further comprising a shaft that is received in a bore formed in the claw pole assembly and a slipring assembly attached to the shaft.
8. The rotor assembly of claim 7 wherein a first end and a second end of the excitation winding are routed along the rear claw pole section and connected to the slipring assembly.
9. The bobbin assembly of claim 1 wherein the first and second end caps are stamped from a thin sheet of polymer.
10. The bobbin assembly of claim 1 wherein the first and second end caps are stamped from a cloth sheet material.
11. The bobbin assembly of claim 1 wherein the first and second end caps are made from a laminated material.
12. The bobbin assembly of claim 1 wherein the first and second end caps are made from a composite material.
13. The bobbin assembly of claim 1 wherein the rigid sleeve is made of metal.
14. The bobbin assembly of claim 13 wherein the metal sleeve is constructed by rolling a cylinder from a flat rectangular sheet of metal.

15. The bobbin assembly of claim 13 wherein the metal sleeve is made from steel.

16. The bobbin assembly of claim 1 wherein the excitation winding is a continuous copper wire that is insulated.

17. A rotor assembly for use with an electrical machine, the rotor comprising:

a bobbin assembly including

a metal sleeve;

a first end cap having inner flaps and outer flaps, the inner flaps being formed inwardly to fit over the metal sleeve;

a second end cap having inner flaps and outer flaps, the inner flaps being formed inwardly to fit over the metal sleeve;

a field coil positioned around the first end cap inner flaps, second end cap inner flaps and metal sleeve, wherein the first end cap outer flaps and second end cap outer flaps are folded around the field coil;

a claw pole assembly having an integrated hub for receiving the bobbin assembly and forming a bore, the claw pole assembly including a front claw pole section and a rear claw pole section;

a shaft positioned within the claw pole assembly bore; and

a slipring assembly connected to the field coil and mounted on the shaft.

18. A method of constructing a bobbin assembly for use in an electrical machine, the method comprising:

- stamping a first end cap from a very thin material, the first end cap having inner flaps and outer flaps;
- stamping a second end cap from a very thin material, the second end cap having inner flaps and outer flaps;
- rolling a cylindrical metal sleeve from a flat rectangular sheet of metal;
- inwardly forming the inner flaps of the first end cap;
- inwardly forming the inner flaps of the second end cap;
- placing the inwardly formed inner flaps of the first end cap over the metal sleeve;
- placing the inwardly formed inner flaps of the second end cap over the metal sleeve;
- winding an excitation winding coil around the metal sleeve, first end cap inner flaps and second end cap inner flaps, where the excitation winding coil is contained by the first and second end caps;
- folding the first end cap outer flaps around the excitation winding coil;
- and
- folding the second end cap outer flaps around the excitation winding coil.

19. The method of claim 18 further comprising wrapping an inner ring of tape around an outside diameter of the first and second end cap inner flaps and metal sleeve.

20. The method of claim 18 further comprising wrapping an outer ring of tape around an outside diameter of the folded outer flaps of the first and second end cap outer flaps.

21. The method of claim 18 further comprising placing the bobbin assembly within a claw pole assembly having an integrated hub.